CLAIMS

1. A device for measuring simultaneously the phase at each point of an image formed by light reflected from a sample, in which the phase has been modified by plasma resonance in a thin conducting layer which is close to, or in contact with, the sample whose image is being recorded, the device comprising:

a thick transparent substrate with a planar surface on which a thin layer of conducting material is deposited, onto which is placed the sample being investigated, either in contact with it or a short distance from it;

a light source linearly polarized in a predetermined direction, whose light beam is reflected from said thin layer of conducting material from the side opposite to that on which the sample is placed at an angle substantially equal to that at which the interaction with the plasma resonance is maximized, the evanescent light field on the far side of the conducting film interacting with the sample, thus modifying the reflected light;

an interferometer which enables the reflected beam to be compared interferometrically with a reference beam derived from the same source, but not having had any interaction with the sample;

an imaging means for recording an image of the planar surface in interference with the reference beam, and digitizing it; and

a processing means for processing said digitized image to provide an output image.

2. A device as claimed in Claim 1, wherein the sample being investigated is placed within up to about 3 wavelengths of the radiation being used for the investigation from said thin layer of conducting material.

3. A device as claimed in claim 1 wherein the light source is a quasi-monochromatic or polychromatic source.

4. A device as claimed in claim 1 wherein the light source is a laser.

5. A device as claimed in Claim 4, wherein said laser is a He-Ne laser.

6. A device as claimed in claim 1 wherein the light source is polarized in the *p*-plane, relative to the sample.

7. A device as claimed in claim 1 wherein the interferometer is a Mach-Zehnder interferometer.

8. A device as claimed in claim 1 in which the interferometer is a Linnik interferometer.

9. A device as claimed in claim 8, wherein the light beam is illuminated annularly, with appropriate radial polarization, so as to illuminate the sample isotropically at an angle substantially equal to that at which the interaction with the plasma resonance is maximized.

10. A device as claimed in claim 1 wherein the imaging means is a Charge-Coupled-Device camera.

11. A device as claimed in claim 1 wherein the image is recorded on a permanent recording material such as photographic film.

12. A device as claimed in claim 1 in which the camera is connected to a computer or other processing device which digitized its output signal and calculates the phase of the reflected image in each pixel using a known algorithm.

13. A method of measuring simultaneously the phase at each point of an image formed by light reflected from a sample, in which the phase has been modified by plasma resonance in a thin conducting layer which is close to, or in contact with, the sample whose image is being recorded, the method comprising the following steps:

One) placing the sample being investigated onto a thin layer of conducting material which is deposited on a thick transparent substrate;

Two) reflecting a light beam linearly polarized in a predetermined direction from said thin layer of conducting material from the side opposite to that on which the sample is placed, at an angle substantially equal to that at which the interaction with the plasma resonance is maximized, the evanescent light field on the far side of the thin layer of

conducting material interacting with the sample, thus modifying the reflected light;

Three) interferometrically comparing said reflected beam with a reference beam derived from the same source, but not having had any interaction with the sample;

Four) recording an image of a planar surface in interference with the reference beam;

Five) digitizing said image; and

Six) processing said digitized image to obtain an output image.